

Grand Theft Auto and Violent Crime

An Honors Thesis HONR 499

by

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Abstract:

Grand Theft Auto is an integral part of modern culture, but the effects on its players are still being debated. In the wake of the Columbine, Aurora, and Newtown shootings—all of which were committed by players of violent video games—it is important to investigate if the recent surge in public killing sprees can be traced to a particular set of causes. Grand Theft Auto, with its open-world gameplay and ability to simulate mass virtual killing sprees, has been suggested as one of the possible causes of the recent surge in mass violence. This paper examines the relationship between the crime rate and the search volume (provided by Google Trends) of Grand Theft Auto cheat codes. We examine time series data for California from October 2004 through December 2010 and panel data for the entire United States from the years 2005-2010. The findings suggest there is no significant relationship between Grand Theft Auto and the crime rate. If such a relationship exists, the relationship is negative, which is shown in both the California time series and the national panel data.

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I: Introduction

It is no secret that the three major violent crime rampages committed by youths in recent memory: Columbine (1999), Aurora (2012), and Newtown (2012) were each committed by players of violent video games. Following the massacre in Newtown, shooter Adam Lanza was said to have used violent video games to simulate his rampage on countless occasions. A week following the shooting, the New York Post hinted at the causal connection between Lanza's shooting spree and the popular violent video game Call of Duty. Palmeri writes:

For hours on end, alone in his windowless basement den, Adam Lanza studied photos of guns and obliterated virtual victims in violent video games — until the virtual became a reality. The unhinged Sandy Hook Elementary School gunman was enthralled by blood-splattering, shoot-'em-up electronic games . . . [and] especially liked “Call of Duty” — a wartime role-playing game where participants use high-powered assault rifles, machine guns and other weapons to slaughter scores of people, according to a published report.

Many researchers and reporters have searched for a connection between violent crime and violent video games, but the relationship remains unclear in the long-term. Though the effects of violent video games on violent crime in the long-term are unknown, there appears to be a short-term connection between the two variables. Carey writes, “Playing [violent] games can and does stir hostile urges and mildly aggressive behavior in the short term . . . Yet it is not at all clear whether, over longer periods, such a habit increases

the likelihood that a person will commit a violent crime, like murder, rape, or assault, much less a Newtown-like massacre.”

Arguing for correlation and causation between violent video games and violent crime has been a central topic of debate across the public sphere for well over a decade. The debate has attracted attention in the political realm, where it is essential for the relationship between crime and its potential causal factors, such as violent video games, to be understood in order to shape policy decisions. Every relevant factor that can be demonstrably observed to positively affect the crime rate should be controlled as long as the cost of the control does not exceed the benefit of the control. Video games have gained tremendous popularity in the general public over the last 20 years and some—especially violent games—have been heavily criticized by politicians. In particular, the possible correlation between violent video games and violent behavior is a central topic of political debate. *Grand Theft Auto* is a focal point for politicians because its provocative nature and widespread popularity makes it an easily identifiable target. Blake writes, “According to politicians like Sen. Hillary Rodham Clinton and New York City’s Mayor Michael R. Bloomberg, the growing popularity of [*Grand Theft Auto IV*] poses a clear and present danger to American society.” It is common knowledge that violence is disproportionately high in America in comparison to other Western nations and that young men commit a great majority of these crimes. As the stereotype conveys, young men are the prime players of violent video games, and an analysis of the relationship between the two is necessary in order to determine if public policy or government intervention is needed in order to lower the crime rate in the United States.

The central goal of my analysis is to investigate the relationship between violent crime and violent video games. The National Consortium on Violence Research (NCOVR), based out of Carnegie Mellon University, provided the crux of my crime data, and Google Trends provided data on players of violent video games. With Google Trends, I was able to select the “hardcore” Grand Theft Auto players¹—those who use cheat codes in order to unlock such “Easter eggs” as unlimited weapons, unlimited health, and other ‘invincible’ aspects that would enable unstoppable virtual killing sprees and would be attractive to a violent personality—from the search results. By examining only those gamers who searched for cheat codes for Grand Theft Auto, I am able to reasonably estimate the concentration of hardcore gamers within a certain area of the population at a certain period of time.

In order to paint the most representative picture of American Grand Theft Auto interest, I conducted research both at the national level and for the state of California alone. Because California contains roughly 12%² of the US population (“California QuickFacts”) and had the most complete and unbiased statistical data, it served as the model state for my analysis. My data from California is monthly, spanning from October 2004 to December 2010. Additionally, I examined the relationship between the national crime rate and Grand Theft Auto cheat code search popularity yearly at the state level from 2005-2010.³

¹ We examined the entire Grand Theft Auto series from Oct. 2004-Dec. 2010 for the California data and from 2005-2010 for the national data. See appendix for search terms included in our analysis.

² 2012 estimate

³ The national data is a panel data set.

My findings suggest there is no significant relationship between Grand Theft Auto and the crime rate. If such a relationship exists, the relationship is negative, which is shown in both the California time series and the national panel data. My findings coincide with a vast array of available studies, in particular, prominent works by Ward, Olson and Kutner,⁴ and Grimes, Anderson, and Bergon.

II: Literature Review

One of the main attractions of Grand Theft Auto is the ability to live and play in a world without rules. Grand Theft Auto is a ‘sandbox’ game; the player is left to dictate how to play the game. The player can follow the missions embedded within the story mode of the game that typically engage the player in a rags-to-riches story-line, heavily satirizing American society and culture in the process, or the player can take advantage of the open-ended opportunities in the game, essentially living as one does in his or her everyday interactions. However, there is one major exception: the player is left with no costs to bear of any unlawful or immoral actions. The marginal cost of murder in Grand Theft Auto is zero; the marginal cost of sleeping with a prostitute is zero; the marginal costs of skydiving from a helicopter, blowing up a hotdog stand with a grenade launcher, and throwing a Molotov cocktail at a police squadron are all zero. It is an anarchist’s dream. Grand Theft Auto allows players to explore a world without rules, unguided by the hand of the law. Hoerrner writes “When we understand this, we can see GTA IV as-among other things-a tool for exploring the limits of our morality when the consequences are

⁴ Authors of *Grand Theft Childhood*

limited, and learning what our consciences dictate in situations where we will not be punished for doing wrong.”

In a virtual reality without rules, when players are allowed to live with no consequences and feel no pain, most players convert to psychopathic maniacs. The most important aspect of *Grand Theft Auto*—and something that most players do not like to admit—is that players engage in all of the vile actions most say they despise: murder, adultery, theft, etc., when they are not responsible for bearing the costs of their actions. Hoerrner continues, “Players of *GTA IV* can use the material at hand to revel in wanton violence and criminality, but they don’t have to. People who haven’t played the game often don’t realize that in *GTA IV*, as in the real world, the purpose of a car, a driver, and a pedestrian can be a carjacking or a hit-and-run killing, but it can also be a taxi ride.” Essentially, the player is free to dictate how he or she wants to live his or her life in the game. It is a shock that when players are presented with the opportunity to live an alternate virtual life, they explore the avenues that they find—or at least they say they do—most distasteful.

Grand Theft Auto forces us to ask a central question about humanity: do violent video games prove that a large majority of us enjoy watching others suffer? Due to the heavy utilization of real-life-simulating sandbox gameplay in *Grand Theft Auto*, the answer is most likely a hesitant, yes. Denzler, Häfner and Förster continue: “[T]here are several motivations that might underlie playing a (violent) computer game . . . such as amusement, relaxation, and achievement goals” (1651).

The debate about whether violent video games impact crime has gained an enormous amount of attention in recent years. Because of its popularity and graphic

depictions of violence, the Grand Theft Auto franchise is central to the debate. Prominent politicians have condemned Grand Theft Auto, calling the franchise a detriment to America's future. Grand Theft Auto has been labeled "the gravest assault upon children in this country since polio" (Thompson qtd. in Blake). The criticism the franchise receives stems from graphic videos of a single virtual killer run amuck in a lifelike urban environment.

Our killer sprays civilians and police officers with thousands of bullets, steals cars, and throws hand grenades at crowded street corners. Hourigan comments: "[T]here is something at least distasteful about being the sort of person who would do this for entertainment-even in a videogame. Would you let your grandmother sit on the couch next to you and watch you set prostitutes on fire?" To critics, the senseless violence within Grand Theft Auto only negatively impacts American youth. Moriarty states, "Used without purpose, sincerity or talent this dissonance [violence] alienates. It effects a forever war. This is the reason non-hobbyists are disdainful of computer games . . . They don't see the justification . . . The fighting just seems to go on and on. It's not the violence, but it's the uselessness of the violence." Critics are justified in lamenting the distasteful acts of violence in Grand Theft Auto; who, of sound mind, would want to watch endless lines of innocent pedestrians be mowed down by a criminal in a stolen car? Who would want to engage in such-grandmother-disapproved acts as setting prostitutes on fire? Apparently, according to the sales figures for the recently released Grand Theft Auto V, 15 million of us (Hickey).

Criticizing Grand Theft Auto for its graphic violence is far from arguing correlation between its play and violent acts carried out outside the framework of the

game. Hourigan argues that the actual amount of violence within the context of the game is irrelevant; his main concern is with “its disturbing and graphic quality” (Hourigan). One of the main points of contention between defenders of violent video games and advocates for their removal from society regards whether players can reasonably differentiate between fiction and reality after playing violent video games. Due to the realistic nature of today’s video games, the gap between the real world and the virtual world is rapidly shrinking. Blake explains the psychological difference between carrying out a violent action in the virtual world and carrying out a violent action in reality. He writes, “You need to determine whether it’s possible for you to change from whoever you were into someone completely different, someone who no longer recognizes the conditions and regulations of a society that, until you played the video game, were all you knew and believed in.”

Grand Theft Auto’s popularity among young people is a prominent point of contention. It is plausible that an impressionable youth could develop violent tendencies from playing Grand Theft Auto. Though every game in the Grand Theft Auto franchise in the modern era has received a rating of “Mature” from the ESRB⁵, which designates the game for players 17 and up, it is common knowledge that “Mature” games find their way into the hands of millions of teens and pre-teens.

Generally, studies attempting to find a relationship between violent video games and the crime rate have produced mixed results. Anderson claims, “We have considerable evidence . . . games cause violent behavior” (qtd. in Hoerrner and Hoerrner). Hoerrner and Hoerrner continue: “[Anderson] point[s] to hundreds of scientific studies on video

⁵Entertainment Software Rating Board

games, and more than 3,000 on the effects of other violent media that he says all suggest a causal link between violent behavior and the consumption of violent content.”

Anderson qualifies his claim by stating, “[There] isn’t an overt link . . . but children will act more aggressively and show more negative social action, such as the intent to do violence to another person, over time” (qtd. in Hoerrner and Hoerrner). Grimes, Anderson, and Bergen debate the legitimacy of Anderson’s claims; they state the “more than 3,000” (ibid.) studies Anderson cites are inherently flawed. They write, “In nearly 80 percent of the studies investigated here, the measures of aggression were paper-and-pencil reports —often simple check marks on a scale . . . There are a few studies that investigate whether the predicted [aggressive] behavior actually occurs (and those few studies indicate that it does not” (qtd. in Entertainment Software Association).

Stating direct causation between violent video games and the crime rate is a bold claim that has yet to be fully proven or disproven by empirical testing. Blake argues that critics of violent media consistently fall into the same trap. He writes, “Media-effects arguments, especially when they follow from a political framing of the issue, always end up claiming a direct, literal transference of negative content to the minds and behaviors of those who are exposed to that content.” By stating that *Grand Theft Auto* is responsible for violent actions—and not the individual him or herself—the proponent of the statement is effectively victimizing the perpetrator; the action is no longer the fault of the individual, who is capable of making logical and rational decisions, but it is the fault of the violent video game, the violent movie, or the violent book that poisons the human mind. Youth are especially susceptible to influence, which is why, in the context of visual entertainment, ratings boards such as the ESRB and the Motion Picture Association of

America (MPAA) assign ratings to each popular work to effectively discriminate among purchasers. Blame in the case of violent actions (said to be influenced by violence media) committed by youths—if blame is to be placed on anyone—should fall on whomever is responsible for not enforcing the ESRB and the MPAA standards. There are certainly some cases where my logic is flawed. Some people—such as the Newtown killer—are psychologically different from the majority of the population, in that they lack empathy. Placing the blame of the Newtown shooting on his obsession with *Call of Duty* (Palmeri) and not on the young man holding the gun—or the parents, friends, or relatives who knew of his condition and remained apathetic—is a point of blame I do not feel comfortable making.

There is a consensus among reputable literature that the link between violent video games and violent crime is impossible to determine, which is due to the near infinite amount of motivations a criminal can have to commit a crime. A landmark study conducted by Michael Ward concluded “that gaming is associated with significant declines in crime and death rates” (261). Ward continues, “These results are robust to various alternative specifications . . . [and they] cast doubt on the desirability of proposed restrictions on video game marketing” (ibid.). Additionally, there has been a general societal trend that weakens the claim that violent video games cause violent crimes. Kutner and Olson write:

Video game popularity and real-world youth violence have been moving in opposite directions. Violent juvenile crime in the United States reached a peak in 1993 and has been declining ever since. School violence has also

gone down. Between 1994 and 2001, arrests for murder, forcible rape, robbery and aggravated assaults fell 44 per cent. (qtd. in Hourigan)

As video games become more popular, it appears that the number of violent crimes decreases. It is important to note, however, that the above study lacks control variables present in my analysis.

Theoretically, Ward believes that violent video games—including *Grand Theft Auto*—could function as an alternate avenue through which violent individuals are able to release their violent urges. Ward writes, “[I]t is . . . plausible that virtual violence tends to diminish one’s marginal utility from further violent activities. If virtual and actual violence are substitutes, increased consumption of violence through virtual gaming would reduce the demand for actual violence” (262). Block agrees, and he suggests that the Columbine High School shootings were the direct cause of Eric Harris and Dylan Klebold being “abruptly denied access to their computers” (qtd. in Human). He continues: “The two young men relied on the virtual world of computer games to express their rage and to spend time, and cutting them off in 1998 sent them into crisis” (qtd. in *ibid.*). Additionally, violent video games could effectively act as a “substitute for the experiences outside the video game play” (Ward 271).

The Entertainment Software Association has assembled various articles on the relationship between violent crime and violent video game play. They state: “[N]umerous authorities, including the U.S. Supreme Court, U.S. Surgeon General, Federal Trade Commission, and Federal Communications Commission, examined the scientific record and found that it does not establish any causal link between violent programming and violent behavior” (Entertainment Software Association). Possibly the most significant

quotation that summarizes the findings of the Supreme Court was made by Supreme Court Justice Antonin Scalia during *Brown v. EMA/ESA*. Justice Scalia stated, “Psychological studies purporting to show a connection between exposure to violent video games and harmful effects on children do not prove that such exposure causes minors to act aggressively” (qtd. in Entertainment Software Association).

If we accept critics’ claims that *Grand Theft Auto* influences youth crime (and thus conclude that the ESRB rating system does not deter young people from playing *Grand Theft Auto*), there are various methods that can be implemented to combat violence among young people. Patacchini argues that “peer effects” (2) is a central component to youth crime. She writes, “[W]e find significant impact of peers on individual criminal activity for individuals belonging to the same group of friends . . . We believe that conformity is the key element determining economic outcomes that involve interactions with peers” (22). To combat youth crime, a more effective solution may be to first try and eliminate social causes through the implementation of social controls. Patacchini argues that an effective solution eliminates the “key player” (22) within a social group. She continues, “In practice, the planner may want to identify optimal network targets to concentrate (scarce) investigatory resources on some particular individuals, or to isolate them from the rest of the group, either through leniency programs, social assistance programs, or incarceration” (ibid.). Combatting violent behavior through schools may be a much more effective system for culling youth violence without blanket banning an entire art form that is not meant for youth anyway.

As a whole, the literature indicates no correlation or a negative correlation between violent video games and the crime rate. The studies that have found positive

correlation, such as the “more than 3,000” cited by Anderson (qtd. in Hoerrner and Hoerrner) appear to be unsatisfactory within the scientific community due to their reliance on arbitrary methods of determining aggression—such as “d[ol]ing| out hot sauce” (Carey⁶)—that differ greatly from committing an actual act of violence. To my knowledge, a study of the nature I am conducting (using search data) has not been attempted, so it is difficult to predict the outcome of such an untested method of empirical examination.

III: Econometric Models and Data

The purpose of our analysis is to determine if the popularity of Grand Theft Auto within a region affects the crime rate over time. Our independent variable data is from Google Trends, which gives us Grand Theft Auto cheat code search volume. Our main dependent variable data is the number of violent offenses resulting in conviction per 100,000 people, which is provided by the NCOVR. For the California analysis, we will use a time series; for the analysis at the national level, we will use panel data.

In order to gain the most accurate regression possible, we must control for extraneous variables that also affect the crime rate. In the California regression, we will control for the unemployment rate, average rainfall, and average temperature. We control for the unemployment rate, because we predict that the unemployment rate affects crime in a positive manner. As the unemployment rate in a region rises, we expect there will be more crime in that region, because a larger fraction of the population will have no or very

⁶ Carey is discussing a study conducted by “Christopher Barlett, a psychologist at Iowa State University” (Carey).

little (state supported) income. No or very little income may cause people to commit crimes in order to acquire resources they otherwise would have bought if they were employed. We control for average rainfall, because we predict that rainfall affects the crime rate in a negative manner. If there is more rain, criminals may be deterred from committing crimes, because there is added climatic complication to criminal activities; criminals may see rain as a factor that increases get-away times and thus positively affects the chances of being caught by the police. We control for average temperature, because we predict that temperature affects the crime rate in a positive manner: higher temperatures will lead to a greater number of crimes. Our prediction coincides with a study by Anderson. He writes, “As shown by the positive path coefficient for the link between temperature and violent crime . . . temperature was significantly and positively related to the violent-crime rate” (34). Unemployment data are from the Bureau of Labor Statistics; average rainfall and average temperature data are from the National Climatic Data Center.

In the national regression, we control for median personal income, unemployment rate, police expenditures, judicial expenditures, and corrections expenditures⁷ because we can reasonably assume these variables affect the crime rate. We control for median personal income, because we predict that income affects the crime rate in a negative manner: the higher a person’s income, the less likely he or she will be willing to commit a crime. In other words, the higher a person’s income, the greater is the marginal cost (foregone earnings) of that person going to jail. We control for the unemployment rate, because, as with the California regression, we predict that the unemployment rate affects

⁷ Police, judicial, and correctional expenditures are all per 10,000 people.

crime in a positive manner: a higher unemployment rate coincides with a higher crime rate. We control for police expenditures, because we expect that as the amount of funds allocated to police services increases, crime will fall because there will be a greater number of police patrols to deter crime and catch criminals faster (so they cannot escape and commit offenses at a later time). We control for judicial expenditures because we expect that as the amount of funds allocated to judicial services increases, the crime rate will increase. Greater expenditure on judicial services may indicate that better quality lawyers are being hired as public defense attorneys to defend criminals. (Greater expenditure on judicial services may indicate judges of greater skill, but the skill level of judges does not necessarily have as much bearing on the outcome of a case as the skill level of defense lawyers.) We control for corrections expenditures because we expect that as the amount of funds allocated to corrections increases, the crime rate will increase. More funds allocated to corrections may indicate an increase in the quality of jail services. If criminals see jail as a ‘comfortable’ way to get three meals a day and a warm place to sleep, superior jail facilities may act as an incentive for crime rather than a deterrent. The data for police, judicial, and corrections expenditures are from the Bureau of Justice Statistics. The median personal income data are from the United States Census Bureau. Unemployment and population data (used to calculate offenses per 100,000) are from the Bureau of Labor Statistics

The main independent variable `GTA_VOL` is the total search volume for gamers looking for cheat codes for all Grand Theft Auto games for which data was available. The list of search terms is attached in the Appendix. For each search term, Google Trends gives a relative search volume that measures the popularity of each search term over

time. Google assigns a value between 0 and 100 to each point in time for each search term. A value of 100 represents the point in time where a term's search popularity reaches its peak, and conversely, a value of 0 represents the lowest point of search popularity for each term. It is also important to note:

All the results in Google Trends are normalized, which means that we've [Google] divided the sets of data by a common variable to cancel out the variable's effect on the data. Doing so allows the underlying characteristics of the data sets to be compared. . . . Just because two regions show the same percentage for a particular term doesn't mean that their absolute search volumes are the same. Data from these two regions - with significant differences in search volumes - can be compared equally because the data has been normalized by the total traffic from each respective region. (Google⁸)

First, we will examine the California time series.

Descriptive statistics for the California data are summarized in Table 1.

⁸ See: https://support.google.com/trends/answer/87284?hl=en&ref_topic=13975 for a complete description of the statistical details.

	Mean	Standard Deviation	Minimum	Maximum
OFFENSES	465.25	41.57	379.61	538.18
GTA_VOL	360.33	188.42	16.00	1,232.00
UNEMPLOYMENT	7.69	3.02	4.80	12.40
CA_RAIN	1.84	1.98	0.02	7.79
CA_TEMP	59.48	11.42	42.60	79.50
Number of Observations = 75 after adjustments				

Table 1

The California regression includes the following variables:

Dependent Variable:

OFFENSES: Offenses in California resulting in conviction per 100,000 people, monthly,
Oct. 2004-Dec. 2010⁹

Independent Variables:

GTA_VOL: Grand Theft Auto search volume, monthly, Oct. 2004-Dec. 2010

UNEMPLOYMENT: Unemployment rate, monthly, Oct. 2004-Dec. 2010

CA_RAIN: Average rainfall in California, monthly Oct. 2004-Dec. 2010

CA_TEMP: Average temperature in California, monthly Oct. 2004-Dec. 2010

The main equation for our regression is:

$OFFENSES =$

$$\beta_0 + \beta_1 GTA_VOL + \beta_2 UNEMPLOYMENT + \beta_3 CA_RAIN + \beta_4 CA_TEMP + u$$

⁹ OFFENSES is given by dividing the total number of offenses resulting in conviction in California by the total non-institutional population, multiplied by 100,000

Though the economic literature on predicting the sign of the coefficient for GTA_VOL is mixed, I predict the coefficient of GTA_VOL to be negative. I expect that as the number of “hardcore” Grand Theft Auto players in California increases, there will be a decrease in the number of violent offenses, which conflicts with many predictions of mainstream media outlets. My prediction is based on the fact that I believe those with violent tendencies will turn to outlets such as Grand Theft Auto to purge themselves of these urges. Psychologically, while there is some fragmented evidence on the relationship between aggression and violent video games, there is not enough evidence to predict that those with violent tendencies will mimic the violent actions they see in video games. To the contrary, I predict that playing violent video games will have a cathartic effect on violent tendencies.

Next we will examine the national panel data.

Descriptive statistics for the national data are summarized in Table 2.

The national regression includes the following variables:

Dependent Variable:

OFFENSES: Offenses resulting in conviction per 100,000 people, yearly, 2005-2010

Independent Variables:

GTA_VOL: Grand Theft Auto search volume, yearly, 2005-2010

INCOME: Median income, yearly, 2005-2010

UNEMPLOYMENT: Unemployment rate, yearly, 2005-2010

POL_EXP: Police expenditures per 10,000 people, yearly, 2005-2010

JUD_EXP: Judicial expenditures per 10,000 people, yearly 2005-2010

COR_EXP: Correctional expenditures per 10,000 people, yearly 2005-2010

	Mean	Standard Deviation	Minimum	Maximum
OFFENSES	5,843.08	1,609.66	2,153.78	9,993.53
GTA_VOL	187.72	310.75	0	1,634.00
INCOME	49,269.23	7,582.06	32,875.00	68,059.00
UNEMPLOYMENT	6.03	2.35	2.48	13.80
POL_EXP	266.90	111.75	123.00	998.40
JUD_EXP	121.97	47.15	55.00	387.38
COR_EXP	210.73	67.65	106.00	466.00
Cross-sections included: 51 Total panel (balanced) observations: 306				

Table 2

Based on the economic literature, I will use the following regression throughout my analysis.

OFFENSES =

$$\beta_0 + \beta_1 GTA_VOL + \beta_2 INCOME + \beta_3 UNEMPLOYMENT + \beta_4 POL_EXP + \beta_5 JUD_EXP + \beta_6 COR_EXP + u$$

IV: Empirical Results

We will first begin our analysis of the California data by examining the relationship between OFFENSES and GTA_VOL. Throughout our analysis of the California data, we will call this regression Model 1. After running the regression, we receive the following estimated equation:¹⁰

$$\widehat{OFFENSES} = 500.98 - 0.10GTA_VOL$$

Testing at the 5% confidence level, we see that the coefficient for GTA_VOL is significant and negative. The p-value for GTA_VOL is 0.019, which is less than 0.10. Model 1 indicates that an increase in GTA_VOL by one unit (in Google Trends) results in a decrease in the crime rate by 0.10 crimes per 100,000.

Adding our control variables—UNEMPLOYMENT, CA_RAIN, and CA_TEMP—to Model 1 will give us more accurate regression results. Throughout our analysis of the California data, we will refer to the regression model with every control variable as Model 2. After running the California regression that includes the control variables, we receive the following estimated equation:¹¹

$$\begin{aligned}\widehat{OFFENSES} = \\ 518.84 - 0.01GTA_VOL - 11.42UNEMPLOYMENT + 3.06CA_RAIN \\ + 0.57CA_TEMP\end{aligned}$$

¹⁰ The coefficients are Newey-West fixed for a lag of 3 to compensate for any statistical irregularities.

¹¹ See footnote 11.

Testing at the 5% confidence level, we see that the coefficient for GTA_VOL is insignificant and negative. The p-value for GTA_VOL is 0.23, which is greater than 0.10. Model 2 indicates that an increase in GTA_VOL by one unit (in Google Trends) results in a decrease in the crime rate by 0.01 crimes per 100,000.

Table 3 summarizes the results of Models 1 and 2. The standard errors are included in parentheses. “*” indicates significance at the 5% confidence level.

	Model 1 (No control variables)	Model 2 (Control variables)
Constant	500.98* (15.02)	518.57* (19.37)
GTA_VOL	-0.10* (0.04)	-0.01 (0.01)
UNEMPLOYMENT		-11.42* (0.98)
CA_RAIN		3.06 (1.94)
CA_TEMP		0.57* (0.27)
\bar{R}^2	0.19	0.73
Number of Observations = 75		

Table 3

From our results, we see UNEMPLOYMENT and CA_TEMP are the best variables to use to predict the crime rate in California. Removing GTA_VOL and CA_RAIN gives us a more accurate (restricted) model for predicting the crime rate in a state.

Because our best model for predicting the crime rate in California does not include GTA_VOL, we conclude that the number of cheat code-using Grand Theft Auto players

does not have a significant effect on the amount of crime in California. If `GTA_VOL` does affect the crime rate in California, crime will tend to decrease as `GTA_VOL` increases, which is shown in Model 1.

Because the California data is a time series, we will run an additional regression to test the assumption of stationarity, which presumes the mean and variance stay constant across time periods. It is important to test for stationarity, because if the assumption is violated, then the conclusions drawn are incorrect. Looking at a graph of our time series data (shown in Figure 1), we see there is a general decline in the number of offenses in California between the October 2004 and December 2010, which may affect our stationarity assumption. Additionally, there are seasonal variations (highs and lows) within the data that can be controlled for through the use of dummy variables for each quarter. We will add three dummy variables: `Q1`, `Q2`, and `Q3`. The fourth quarter is implied. To test our stationarity assumption, we will add a linear trendline given by the equation $y = -1.6743x + 543.12$. The data points corresponding to the points on the linear trend line are called `LINEAR` in the following regression. We ran the regression using two different methods of coefficient estimation: the coefficients in Model 3 contain no corrections; the coefficients in Model 4 are Newey-West fixed for a lag of 3 to compensate for statistical irregularities. The regression results are given in Table 4.

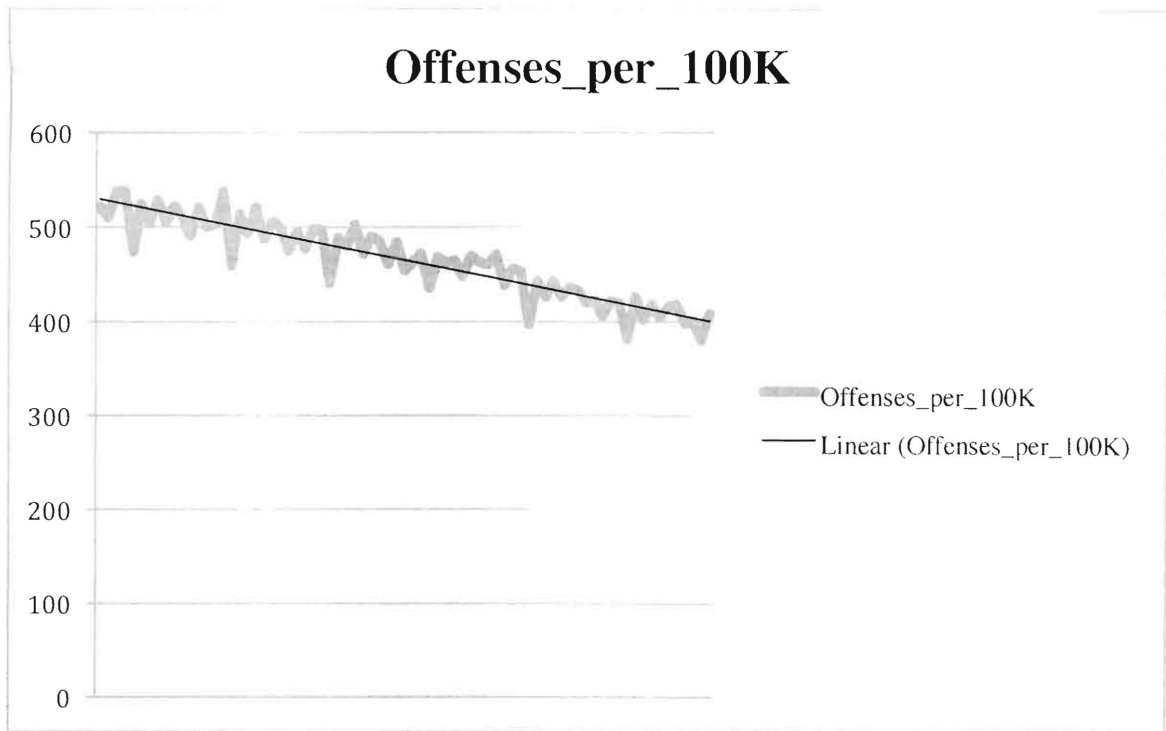


Figure 1

The unlabeled x-axis covers the time period of examination: Oct. 2004-Dec. 2010.

After running the regressions, we receive the following results:

	Model 3 (No coefficient corrections)	Model 4 (Coefficients: Newey-West fixed for a lag of 3)
Constant	42.78 (70.09)	42.78 (38.30)
GTA_VOL	0.01 (0.01)	0.01 (0.01)
UNEMPLOYMENT	-2.77* (1.40)	-2.77* (0.80)
CA_RAIN	0.90 (1.48)	0.90 (1.62)
CA_TEMP	0.47 (0.41)	0.47 (0.31)
Q1	-4.06 (5.56)	-4.06 (3.36)
Q2	-4.21 (6.58)	-4.21 (3.71)
Q3	-4.33 (9.45)	-4.33 (6.51)
LINEAR	0.89* (0.12)	0.89* (0.07)
\bar{R}^2	0.84	0.84
Number of Observations = 75		

Table 4

From the table, we see that GTA_VOL is positive but insignificant in Models 3 and 4.

Therefore, from our test of the stationarity assumption, we conclude there is no significant relationship between GTA_VOL and OFFENSES in California. This conclusion coincides with our findings in Model 2 and differs from our findings in Model 1. Because Models 2, 3, and 4 are more refined and control for additional factors that affect the crime rate, we ultimately conclude from the California time series that GTA_VOL has no significant impact on the crime rate in California.

We will first begin our analysis of the national panel data by examining the relationship between OFFENSES and GTA_VOL. Throughout our analysis of the national data, we will call this regression Model 1. After running the regression, we receive the following estimated equation:

$$\widehat{OFFENSES} = 5,853.87 - 0.06GTA_VOL$$

Testing at the 5% confidence level, we see that the coefficient for GTA_VOL is insignificant and negative. The p-value for GTA_VOL is 0.847, which is greater than 0.10. Model 1 indicates that an increase in GTA_VOL by one unit (in Google Trends) results in a decrease in the crime rate by 0.06 crimes per 100,000.

Model 1 does not control for exogenous factors that are unique to every state. To account for different characteristics between states, we will use fixed cross-section effects.

Throughout our analysis of the national data, we will call this regression Model 2. After running the regression, we receive the following estimated equation:

$$\widehat{OFFENSES} = 5,959.00 - 0.62GTA_VOL$$

Testing at the 5% confidence level, we see that the coefficient for GTA_VOL is significant and negative. The p-value for GTA_VOL is 0, which is less than 0.10. Model 2 indicates that an increase in GTA_VOL by one unit (in Google Trends) results in a decrease in the crime rate by 0.62 crimes per 100,000. This finding carries substantial weight, because cross section fixed effects control for all exogenous factors between the states.

Additionally, there may be aggregate trends that affect our analysis, so we will control for period fixed effects in addition to cross section fixed effects. Throughout our analysis of the national data, we will call this regression Model 3. Controlling for cross section fixed effects and period fixed effects yields the following regression model:

$$\widehat{OFFENSES} = 5,897.60 - 0.12GTA_VOL$$

Testing at the 5% confidence level, we see that the coefficient for *GTA_VOL* is insignificant and negative. The p-value for *GTA_VOL* is 0.411, which is greater than 0.10. Model 2 indicates that an increase in *GTA_VOL* by one unit (in Google Trends) results in a decrease in the crime rate by 0.12 crimes per 100,000.

Table 5 summarizes the results of Models 1 through 3. The standard errors are included in parentheses. “*” indicates significance at the 5% confidence level.¹²

	Model 1 (No fixed effects)	Model 2 (Cross section fixed effects)	Model 3 (Cross section and Period fixed effects)
Constant	5,853.87* (107.72)	5,959.00* (33.31)	5,897.60* (71.20)
GTA_VOL	-0.06 (0.30)	-0.62* (0.13)	-0.12 (0.14)
\bar{R}^2	0	-0.10	0.16
Cross Sections Included: 51 Periods Included: 6 Total Panel Observations: 306			

Table 5

Adding our control variables—*INCOME*, *UNEMPLOYMENT*, *POL_EXP*, *JUD_EXP*, and *COR_EXP*—to Models 1, 2, and 3 will give us more accurate regression results.

¹² It is important to note that the models in Table 4 and Table 5 do not have pairwise correlation, heteroscedasticity, or multicollinearity problems

Throughout our analysis of the national data, we will refer to the regression model with every control variable added to Model 1 as Model 1C. After running the national data regression that includes the control variables, we receive the following estimated equation:

$$\widehat{OFFENSES} = 7,883.65 - 0.27GTA_VOL - 0.07INCOME - 49.86UNEMPLOYMENT + 4.91POL_EXP - 0.82JUD_EXP + 3.20COR_EXP$$

Testing at the 5% confidence level, we see that the coefficient for GTA_VOL is insignificant and negative. The p-value for GTA_VOL is 0.366, which is greater than 0.10. Model 1C indicates that an increase in GTA_VOL by one unit (in Google Trends) results in a decrease in the crime rate by 0.27 crimes per 100,000.

We will now add cross section fixed effects to our model with control variables. Call this regression Model 2C. Controlling for cross section fixed effects in our model with control variables, we receive the following estimated equation:

$$\widehat{OFFENSES} = 7,197.96 - 0.01GTA_VOL - 0.004INCOME - 92.86UNEMPLOYMENT - 1.23POL_EXP - 0.82JUD_EXP + 3.20COR_EXP$$

Testing at the 5% confidence level, we see that the coefficient for GTA_VOL is insignificant and negative. The p-value for GTA_VOL is 0.921, which is greater than 0.10. Model 2C indicates that an increase in GTA_VOL by one unit (in Google Trends) results in a decrease in the crime rate by 0.01 crimes per 100,000.

We will now add both cross section fixed effects and period fixed effects to our model with control variables. Call this regression Model 3C. Controlling for cross section fixed effects and period fixed effects in our model with control variables, we receive the following estimated equation:

$$\widehat{OFFENSES} = 6,175.98 - 0.01GTA_VOL - 0.01INCOME + 0.46UNEMPLOYMENT + 3.41POL_EXP - 1.17JUD_EXP - 1.22COR_EXP$$

Testing at the 5% confidence level, we see that the coefficient for GTA_VOL is insignificant and negative. The p-value for GTA_VOL is 0.965, which is greater than 0.10. Model 3C indicates that an increase in GTA_VOL by one unit (in Google Trends) results in a decrease in the crime rate by 0.01 crimes per 100,000.

Table 6 summarizes the results of Models 1C through 3C. The standard errors are included in parentheses. “*” indicates significance at the 5% confidence level.

	Model 1C (No fixed effects)	Model 2C (Cross section fixed effects)	Model 3C (Cross section and Period fixed effects)
Constant	7,883.65* (642.73)	7,197.96* (453.78)	6,175.98* (811.17)
GTA_VOL	-0.27 (0.29)	-0.01 (0.13)	-0.01 (0.15)
INCOME	-0.07* (0.01)	-0.004 (0.01)	0.01 (0.01)
UNEMPLOYMENT	-49.86 (39.40)	-92.86* (13.72)	0.46* (1.62)
POL_EXP	4.91* (1.08)	-1.23 (1.52)	3.41 (1.18)
JUD_EXP	-0.82 (2.57)	-0.76 (2.51)	-1.17 (2.57)
COL_EXP	3.20 (1.98)	-0.84 (1.46)	-1.22 (1.54)
\bar{R}^2	0.18	0.17	0.19
Cross Sections Included: 51 Periods Included: 6 Total Panel Observations: 306			

Table 6

From our analysis of the national panel data, we conclude that there is no statistical relationship between GTA_VOL and the crime rate, and if there is, the relationship is most likely negative, as shown in Model 2. Because the national data set is more extensive, the findings from the national data ultimately carry more conclusive weight (in determining the relationship between Grand Theft Auto and the crime rate) than our previous examination of California. From our examination of the California time series and the national panel data, it is clear that there is no relationship between Grand Theft Auto and the crime rate, and if there is, the relationship is negative.

V: Conclusion

As we have shown, there does not appear to be a significant relationship between Grand Theft Auto search volume and the crime rate. This conclusion coincides with a number of studies, most notably works by Ward, Olson and Kutner,¹³ and Grimes, Anderson, and Bergon. People with violent personalities could be more apt to play Grand Theft Auto (and search for cheat codes), which may be a deterrent to crime. Through violent video games, violent individuals are able to act on their violent urges without causing harm to another person. Additionally, it does not appear that Grand Theft Auto causes non-violent individuals to become violent after playing the game. America's notoriously high crime rate appears to be caused by external factors outside of Grand Theft Auto. It appears that there are certain cultural pressures in America—independent of video games—that cause individuals to commit more violent crimes in comparison to other Western countries.

While our conclusions coincide with the current literature on the relationship between violence and video games, it is important to note the shortcomings of our analysis. It is possible that Google Trends could not be the best manner with which to measure the amount of Grand Theft Auto players; it may be possible that the majority of violent Grand Theft Auto players use an alternative search engine such as Bing or Yahoo. It is also possible that other violent games, such as Call of Duty, Battlefield, or Assassin's Creed, have a significant positive effect on crime. By examining only Grand Theft Auto, we systematically ignored every other violent game that may impact the crime rate. Additionally, it is possible that we committed a type II error, which is a statistical false

¹³ Authors of *Grand Theft Childhood*

negative. Though our hypothesis is robust under various assumptions, the possibility of a type II error still exists, and Grand Theft Auto may impact the crime rate.

This study has shown that there is a no significant relationship between ‘hardcore-cheat-code-searching’ Grand Theft Auto players and the crime rate, which implies that Grand Theft Auto does not affect crime in the aggregate. The recent massacres, committed by psychologically unfit individuals, does not imply that Grand Theft Auto—and by extension, any other violent video game—affects society in a negative manner.

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Appendix:

Grand Theft Auto Search Terms for California Data

- gta san andreas cheats
- grand theft auto san andreas cheats
- gta iv cheats
- gta iv cheat codes
- gta 4 cheats
- grand theft auto 4 cheats
- grand theft auto iv cheat codes
- grand theft auto iv codes
- grand theft auto iv cheat codes
- grand theft auto iv codes
- gta liberty city stories cheats
- gta liberty city stories cheat codes
- gta liberty city stories codes
- grand theft auto liberty city stories cheats
- grand theft auto liberty city stories cheat codes
- grand theft auto liberty city stories codes
- gta vice city stories cheats
- gta vice city stories cheat codes
- gta vice city stories codes
- grand theft auto vice city stories cheats
- grand theft auto vice city stories cheat codes
- grand theft auto vice city stories codes

Grand Theft Auto Search Terms for National Data

- gta san andreas cheats
- grand theft auto san andreas cheats
- grand theft auto liberty city stories cheats
- gta vice city stories cheats
- gta IV cheats
- gta 4 cheats
- gta 4 cheat codes
- grand theft auto 4 cheats
- grand theft auto 4 cheat codes
- grand theft auto 4 codes
- gta IV codes
- grand theft auto IV cheat codes
- gta IV codes
- gta san andreas cheat codes
- gta san andreas codes
- grand theft auto san andreas cheat codes
- grand theft auto san andreas codes
- gta vice city cheats